ever, better to have all metal areas where the disc hits the struts polished, as in all other patients (patients 4-12).

The area adjacent to the suture ring is the important place to have a microporous surface to bind down the covering from the suture ring. After 11 to 13 years of follow-up of 12 patients with the Björk-Shiley Monostrut mechanical mitral valve with a microporous surface and without anticoagulation, 9 children have been born and no thromboembolic complications have been encountered.

Summary. This microporous surface will be covered in 3 months by a thin, smooth, glistening endothelium, free from excrescence formation and fibrin precipitation, extending over the groove and adjacent part of the suture ring. Thus the thicker fibrous covering over the suture ring will be connected with the microporous covering. This will prevent a thrombotic protrusion into the valve orifice with risk for emboli. As the Monostrut valve has been accepted by the Food and Drug Administration after 16 years of successful clinical use, the results achieved from this pilot study indicate the necessity of a multicenter study, the outcome of which could solve valve surgery problems, especially for young girls.

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A fatal mechanical disorder of the TCI HeartMate left ventricular assist system

To the Editor:

The HeartMate vented electric (VE) left ventricular assist system (LVAS) (TCI; Thermo Cardiosystems Inc, Woburn, Mass) has been used in more than 1400 patients worldwide and in 42 patients in our hospital since November 1995. We experienced a case of fatal mechanical disorder with this device, which required an emergency exchange of the LVAS. The patient was a 34-year-old man who had undergone implantation of the HeartMate VE LVAS because of dilative cardiomyopathy more than 1 year earlier. He was referred to us twice for

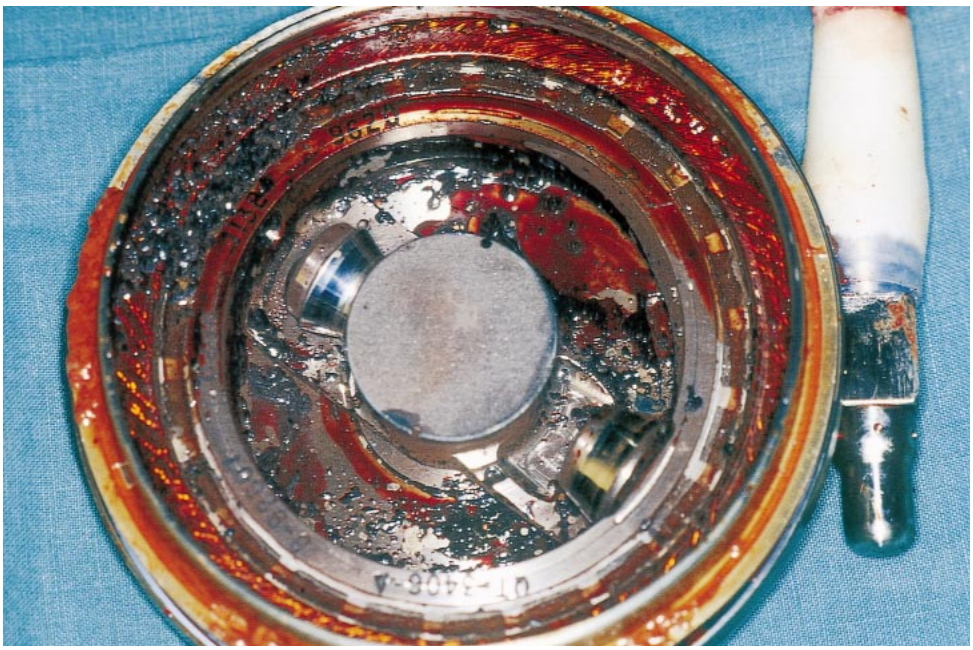

Fig 1. Clotted blood was seen in the whole LVAS motor chamber, which prevented the pump from working.

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problems with a cable. In both events, the LVAS worked normally and the patient's condition was stable. The cable was thoroughly examined and repaired by a technician from TCI. Four days after the second cable repair, the red alarm suddenly warned at home. The manual mechanical pumping with the hand pump was immediately initiated by the patient himself, and he was transferred to our hospital urgently by helicopter. During the transport his condition worsened and he needed to be intubated. This emergency occurred 380 days after the LVAS implantation. The LVAS could still work with the pneumatic system, so that his hemodynamic condition was well controlled with dopamine perfusion. The problem with the LVAS was studied by a technician from TCI. Because dried bloodlike material was observed in the hand pump and the stroke volume limiter connecting tube, we suspected a rupture of the drive line or the diaphragm separating the blood pump chamber from the motor chamber in the LVAS. We exchanged the LVAS through the incision in the abdominal pocket with cardiopulmonary bypass established through the femoral artery and vein. The postoperative course was excellent. He was discharged to his home on postoperative day 24 and is now waiting for heart transplantation. The explanted pump was carefully examined. The motor chamber was filled with clotted dried blood, which prevented the motor/cam assembly from working (Fig 1). However, by macroscopic observation we could not find any tears or holes in the diaphragm. The pump was sent to TCI for precise inspection. TCI's technicians detected small tears at the rim of the diaphragm, which might have been caused by mechanical fatigue.

The TCI HeartMate LVAS is one of the most reliable systems in the world.[1,2] We have implanted the pneumatic HeartMate LVAS in 14 patients since April 1994 and the VE HeartMate LVAS in 28 patients since November 1995.[3] A similar device disorder with the VE HeartMate LVAS was reported by Piccione and colleagues[4] in 1998. They showed, as in this report, that the motor chamber filled with clotted blood. However, they could not find any perforation on the drive line, and they did not refer to the diaphragm. To our knowledge, this is the first report of a disorder of the diaphragm in the pump with the VE HeartMate LVAS. The support time of this patient was 380 days. This long support time might be one of the reasons for this defect.

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A word of caution in extrapolating the spinal cord protective effects of memantine obtained in a rabbit model under ketamine anesthesia

To the Editor:

We read with great interest the article titled "Memantine for Prevention of Spinal Cord Injury in a Rabbit Model" by Ehrlich and associates (J Thorac Cardiovasc Surg 1999;117: 285-91). We do not doubt the protective effects exhibited by memantine, a noncompetitive *N*-methyl-D-aspartate (NMDA) receptor antagonist, and we believe it is a significant contribution to central nervous system protection.

However, we would like to bring a few points to the attention of the readership:

1. The protective effects of NMDA antagonists are widely known.[1] Part of that protection is due to the hypothermic effect of NMDA antagonists.[2] In any study to assess protection, specifying only the ischemic time is not enough; specifying the temperature as well, preferably the esophageal temperature, is almost mandatory.

2. The temperature was monitored rectally and, although a heating pad was used to maintain normal body temperature, it would have been informative to specify the temperature itself. We have found that esophageal temperatures more closely reflect spinal cord temperatures than do rectal temperatures.[3] Rectal temperatures are usually higher than esophageal temperatures, sometimes by as much as 0.5°C to 1.2°C, and esophageal temperature differences as small as 0.5°C might result in totally different neurologic outcomes.[2,3]

3. Their anesthesia protocol included ketamine, which resulted in instant loss of transcranial motor-evoked potentials. This can be explained on the basis of the known NMDA receptor antagonism of ketamine, which is responsible for the reported protective effects.[1,4] Thus the observed protective effects of memantine were the result of the effects of memantine by itself in addition to those contributed by ketamine, but their relative roles are unknown. For definitive assessment of the protective effects of memantine alone, a group of rabbits anesthetized with nonprotective concentrations of volatile agents without ketamine or barbiturates is essential before the data can be extrapolated to human application, because ketamine is no longer widely used in humans.

4. Obviously, slow intravenous infusion of memantine over a 30-minute period before ischemia resulted in better protection than a fast (3-minute) intra-arterial infusion into the aorta